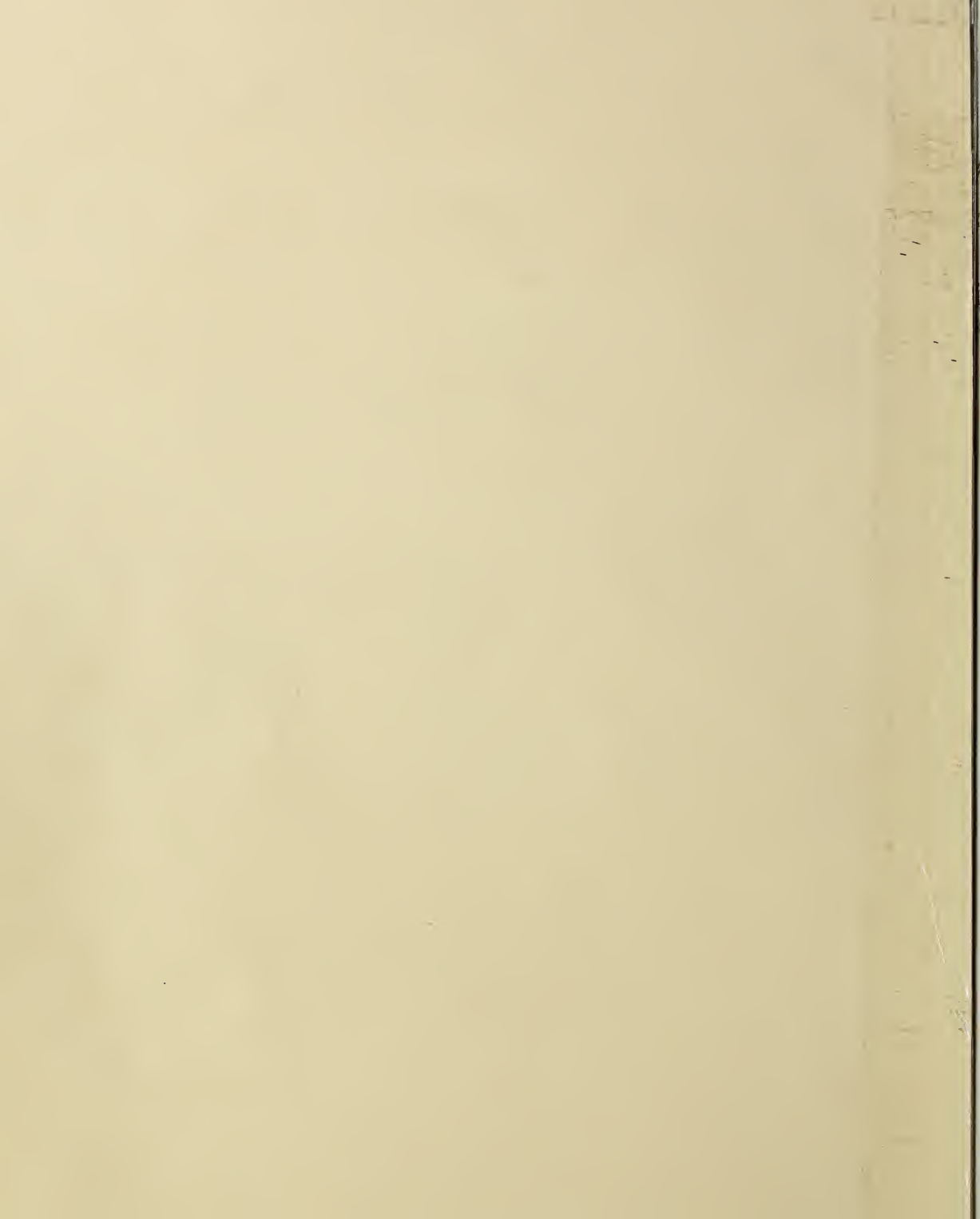


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AGRICULTURAL Research

MAY 1964

U.S. DEPARTMENT OF AGRICULTURE



From Oats, A Natural
Food Preservative Page 5

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Unseen Assets

A Midwestern farmer looking over his weed-infested hayfield scratches his head and remarks, "There must be some way to use quackgrass. It's the most persistent weed I've ever tried to get rid of."

Remarks similar to this have been made repeatedly through the years. Now, an ARS plant geneticist has responded by combining the persistence and leafiness of quackgrass with drought resistance and better seed quality of crested wheatgrass (page 3, this issue).

Although results are preliminary, this inquisitive geneticist is optimistic that the resulting hybrid grass will eventually provide Western ranchers and farmers with a valuable forage and cover crop.

This research illustrates the close scrutiny being given plant and animal life for many hidden or unseen assets that can be used by man.

- English scientists, for example, working under the PL-480 program, have found a natural food preservative in oats (page 5, this issue). The grain has been known by man for many centuries, yet hidden from him until recently was an asset that could improve the keeping qualities of many foods the world over.

- Scientists are uncovering hidden assets in the insect world—and using them to control or eradicate insect pests (AGR. RES., August 1963, p 2). But, sometimes, they desire not to eradicate an insect but to put it to work controlling another kind of pest.

A European moth, for example, has been introduced in California, where it is helping eradicate Scotch broom, a shrub that has become a noxious weed (page 14, this issue). The moth was imported from Europe after entomologists recognized and confirmed that it has a singular attraction to the weed shrub.

- Another insect, the Angoumois grain moth, is being used in laboratory studies by plant breeders because it prefers to feed on strains of corn with a low content of amylose starch. This preference helps breeders locate strains that are high in amylose starch, a substance with great potential as a raw material for making durable fibers, plastics, and transparent films.

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Editor: R. E. Enlow

Contributors to this issue:

W. E. Carnahan, D. W. Goodman,

M. E. Haun, K. M. Horne,

V. R. Marcley, W. W. Martin,

J. N. Miller, J. R. Parker,

H. H. Smith, J. H. White,

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Orville L. Freeman, Secretary,
U.S. Department of Agriculture

B. T. Shaw, Administrator,
Agricultural Research Service

One of the most persistent weeds—quackgrass—offers potential in a cross with crested wheatgrass

A New Hybrid Grass

■ Hybrid grass with the vigor and leafiness of quackgrass and the drought resistance and better seed quality of crested wheatgrass may eventually become available to western ranchers and farmers.

ARS plant geneticist D. R. Dewey has produced quackgrass-crested wheatgrass hybrids that have highly desirable forage characteristics. But breeding problems prevent their immediate practical use. Present hybrids set very few fertile seeds, and the offspring that are produced may or may not be similar to the hybrid parent.

The aim of Dewey's research, in cooperation with the Utah Agricultural Experiment Station, Logan, is to produce a stable hybrid having the desired characteristics of the parent grasses. Such a hybrid could provide valuable forage and cover growth in the intermountain rangelands, and the area of adaptation might extend into the northern and central Great Plains.

In addition to its potential practical value, this first successful effort to produce hybrids between quackgrass and crested wheatgrass is a significant contribution to the basic knowledge of grass hybridization.

Crested wheatgrass, a hardy dry-land bunchgrass, is considered one of

the best grasses in the Great Plains and the intermountain regions of the western United States for reseeding native range or for seeding on land that has been under cultivation. Once established, crested wheatgrass is very persistent and will compete with native grasses.

Crested wheatgrass has high feed value and provides excellent forage in the spring. But by early summer, the plant flowers and the leaves dry out and fall off. Only the tough stems remain.

The vigorously aggressive quackgrass thrives in more humid regions. Although generally regarded as a weed, it has value for forage and hay and as a cover plant to prevent soil erosion. Since quackgrass has a longer grazing season than crested wheatgrass, a hybrid might provide high-quality forage for a longer period in areas where crested wheatgrass is grown.

The experimental hybrids are leafier than crested wheatgrass, are mildly spreading, and make a very acceptable forage. But the plants frequently are sterile, and the few seeds that are formed usually result from backcrossing to one of the parents. These seeds produce plants resembling quackgrass, crested wheatgrass, or any other plant that is com-



New hybrid grass makes lush growth, combines good characteristics of both quackgrass and crested wheatgrass. This plant is 4 feet tall.

bined in their genetic background.

Dewey is trying several breeding techniques to overcome this genetic roadblock. One technique involves controlled pollination, to prevent backcrossing to the parent species. Self-pollination and crossbreeding, the scientist believes, might lead to a stable hybrid that retains the right combination of desirable characteristics.

In another test, aimed at breaking sterility, the number of chromosomes in cells of sterile first-generation hybrids are doubled through the use of chemicals such as colchicine (a drug used by plant breeders to induce mutations in plants). Most plants in Nature have two sets of chromosomes—the bodies that carry genetic

A New Hybrid Grass

(Continued)

inheritance factors—in each cell. When crossing produces hybrids with an odd number of chromosomes, pairing is not possible, and sterility results. Doubling the hybrid's chromosomes corrects this imbalance and restores fertility in some hybrids.

A few of the hybrids produce pollen grains and egg cells that have the same number of chromosomes as the vegetative cells. Normally, the reproductive cells have only half as many chromosomes. When these hybrids are backcrossed to either quackgrass or crested wheatgrass, plants with low to fairly high fertility are produced.

Further research is necessary to determine whether, through subsequent self-pollination or crossbreeding, the desired hybrid grass can be established in the field. ☆



Two hybrid seed spikes (center) are flanked by those of one parent, quackgrass (left), and those of the other parent, crested wheatgrass (right).

Evaluating Limestone

Chemists recommend simplified method of determining particle size

■ Farmers can evaluate agricultural limestone more readily should the industry choose to adopt the simplified specifications on distribution of particle sizes suggested by ARS chemists.

Only two numbers, instead of the present four, describe particle sizes in limestone by the standardized system recommended by C. W. Whittaker and P. P. Chichilo of the U.S. Fertilizer Laboratory, Beltsville, Md.

The proportions of both small particles and very large particles are important in assessing the value of a limestone product for correcting soil

acidity. Small particles act immediately in the soil, but very large ones have little practical effect on soil acidity.

Oversize particles usually are not present because most or all of a sample must pass through a relatively coarse "primary" sieve. An additional requirement that a percentage pass through a fine, secondary sieve assures presence of finer particles.

Any comparison of limestones is difficult, however, because the percentages of the product that must pass through the primary sieve and through the secondary sieve are not uniform.

And the openings in the sieves used (indicated by number) also vary.

The chemists recommend that the primary sieve always pass 95 percent of the sample and the secondary sieve pass 50 percent. They say the secondary sieve, when it is identified with the average particle size, can determine fineness more completely and simply than any other single sieve and percentage combination.

Farmers would then need to remember only two figures—the primary and secondary sieve numbers. The percentages for each sieve number would always be 95 and 50. ☆

PL-480 researchers in England isolate a new antioxidant in oats that offers promise as . . .

A Natural Food Preservative

■ England, the country that once contributed a dictionary defining oats as "a grain which is generally given to horses, but in Scotland supports the people," has now contributed important research on that grain—consumed by both horses and people in the United States.

As a result of this research, oatmeal and other oat products in all countries may soon have better keeping qualities. The English scientists have isolated a new group of antioxidants from oats that could have wide application in maintaining quality of foods and feeds.

Antioxidants in grains are capable of the grain products and lessening the breakdown of vitamins and essential fatty acids. But the antioxidants are partially inactivated during processing and therefore are unable to prevent spoilage and breakdown for prolonged periods.

After isolating the new antioxidants, the English scientists split them into their component parts and recombined some of these components in various ways to produce antioxidants that are soluble in water and also antioxidants that are soluble in fats.

The work was done by the Research Association of British Flour Millers, St. Albans. Financial support was furnished by an ARS-administered grant under Public Law 480—the law that authorizes agricultural research in foreign scientific institutions paid for with foreign currency that has accrued to the United States from sale of surplus agricultural commodities to friendly countries.

For some time before the scientists

discovered the new group of antioxidants, it had been generally known that oats contain two other antioxidants, which help prevent deterioration of raw products but permit deterioration when the products are subjected to heat in processing and storing. The new antioxidants contain caffeic acid, and it is hoped they will slow down spoilage even when the oat products are processed.

This knowledge may lead to better keeping qualities for oat products and hence to new uses for oats. The properties of the new antioxidants are compatible with a wide range of foodstuffs, including breakfast foods, canned foods, salad and cooking oils, margarines, and shortenings. The fact that they can be modified to be soluble in either oil or water should improve the distribution of the antioxidant through foodstuff.

Earlier research in England had emphasized the importance of fat-splitting enzymes in deterioration and had proved that the effects of the enzymes could be eliminated. But only preliminary investigations had been done on the prevention of rancidity in oat products caused by oxidation from heat or air.

The fact that a stabilizer for the ground oat products can be made from naturally occurring substances is of particular importance to consumers in the United States, where nearly a billion bushels of oats a year are used for breakfast foods and processed feed for animals. Both the breakfast foods and the processed feed for animals now have poor keeping qualities.

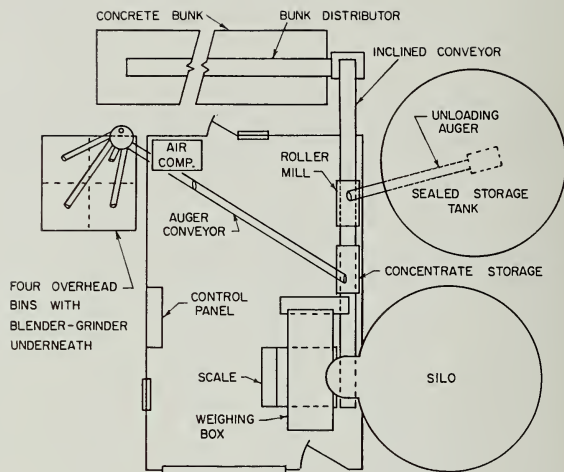
Patent applications on the various

chemical modifications of the new antioxidants have been filed in the United States and in England.☆



Automated Feeding

New system blends a balanced beef ration, delivers it to feed bunk



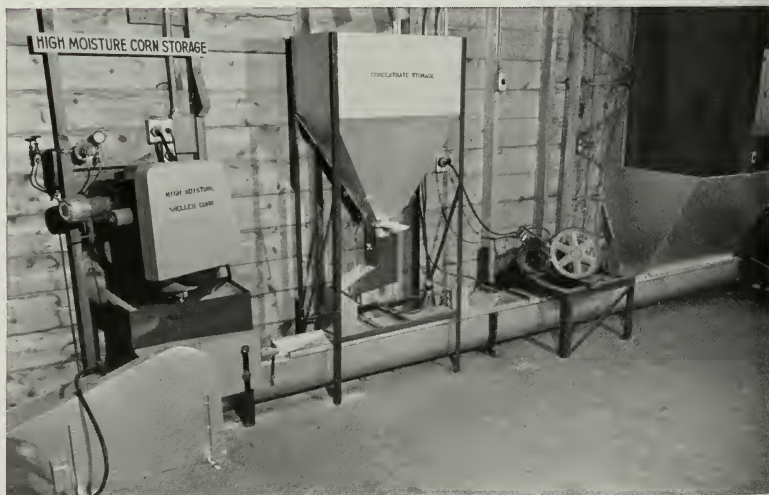
■ A system that automatically removes silage, grain, and concentrates from storage, blends them into a balanced ration, and delivers the ration to beef cattle has been engineered by ARS and Illinois Agricultural Experiment Station researchers at Urbana.

Key to the system is an electronic control panel developed by agricultural engineers H. B. Puckett of ARS and D. R. Daum of the Illinois station.

Controls in the panel can be set to feed cattle automatically as often as desired—from once an hour to once a day. Two different rations can also be fed to two groups of cattle without changing the control settings.

Silage is removed from an upright silo by a commercial silage unloader that has been modified by the engineers to deliver, with 95 percent accuracy, a preset amount of silage.

Daum and Puckett modified the unloader by replacing its 3-horsepower motor with two motors—a 1½-hp. motor that drives the unloader and cuts the silage loose and a 3-hp. motor that moves the loosened silage out of the silo and into the system.



Feed ingredients are mixed and conveyed through this system, which includes (left to right) unloading equipment and roller mill for high-moisture corn, surge bin and vibrator meter for concentrate, power winch, and silage hopper.

The 3-hp. motor delivers an amount of silage that is proportional to the amount of current (amps) being used by the motor. For example, if the motor is delivering 95 pounds of loose silage a minute, it is using about 8.5 amps of current.

If the silage delivery rate varies from 95 pounds a minute, the current demand of the motor changes and a relay automatically tells a hoist motor to lower or raise the unloader to cut more or less silage until the delivery rate is back to 95 pounds a minute.

Loosened silage is conveyed by the unloader to a chute outside the silo, where it drops to the base of the silo and into an auger.

Grain and concentrates are conveyed from other storage areas to the auger, where they are blended and delivered in metered amounts to the feed bunk. (See illustrations.) Another auger above the feed bunk distributes the ration uniformly to either or both sides of the bunk.

Safety devices stop the system if a motor overloads or if the flow of silage stops longer than 90 seconds. Warning lights on the control panel and an exterior light on top of the silo light up when trouble develops.☆

Balanced feed ration is augered into feedlot from the building behind feedbunk, where equipment and controls are housed. Grain, silage, and concentrates are stored in the other structures.



COTTON . . .

Grown in 9-inch rows . . . is produced at 27 percent less cost

High Plains farmers may someday plant cotton with a grain drill, if ARS agricultural engineers at the Texas Agricultural Experiment Station, Lubbock, continue to achieve low production costs with cotton grown in 9-inch rows.

By planting cotton in rows only 9 inches apart, engineers D. F. Wanjura and E. B. Hudspeth, Jr., have produced lint at 27 percent less cost per pound than that grown in 40-inch rows. Yields from the two planting methods were comparable.

The difference in cost of production is attributed largely to several machine cultivations and hand hoeing that were necessary to control weeds in cotton grown in 40-inch rows but that were not necessary in cotton grown in 9-inch rows.

The narrow-row cotton was seeded six rows at a time with a conventional vegetable planter. Hudspeth says acid-delinted cotton seed could be planted with a grain drill.

Lint quality of the narrow-row cotton was almost identical to that of the 40-inch row cotton, and its spinability was good. Tests also showed that narrow-row planting had no adverse effect on cottonseed quality.

The engineers planted at a rate of some 240,000 plants per acre in the narrow-row plot (40,000 is normal) applied a pre-emergence

herbicide, and sprinkler irrigated with 3 inches of water to activate the herbicide and aid germination.

Weeds didn't have a chance, because the pre-emergence herbicide controlled early-season growth and the closely spaced plants shaded out other weeds as they emerged. Although each plant produced only two or three bolls, the increased number of plants boosted the total yield.

Both the 40-inch-row plots and the 9-inch-row plots were sprinkler irrigated three times during the growing season, both received 80 pounds of nitrogen and 40 pounds of phosphorus per acre before planting, and the 9-inch cotton received the pre-emergence herbicide treatment in place of the hand and machine cultivations.

Wanjura and Hudspeth harvested the cotton with a stripper harvester modified by ARS agricultural engineer I. W. Kirk to operate in 9-inch rows. Conventional strippers—designed for 40-inch rows—are used primarily in the High Plains of Texas and Oklahoma.

Gregg cotton, an early maturing, stormproof variety, was used in the tests. Other varieties may produce different results, Hudspeth points out. In fact, Hudspeth says future research may show the need for a cotton variety that is particularly suited to narrow-row planting and harvesting.



Hog Cholera

RESEARCH ROUNDUP

*Pilot studies, laboratory experiments
back up national eradication campaign*

■ A nationwide campaign to eradicate hog cholera is gaining momentum. To back up this Federal-State effort, ARS and State scientists are conducting laboratory and pilot studies of eradication procedures.

Single Versus Double Vaccination

In a 5-year Iowa farm study, ARS veterinarians gave single vaccinations of killed hog-cholera vaccine to 67,558 pigs 2 weeks after weaning. The scientists found that most of the pigs got adequate protection. Those that got little or no protection were unable to develop sufficient antibodies following vaccination.

Two vaccinations, one given 2 weeks after weaning and one a month later, overcame this inability of some pigs to develop immunity. For example, in four herds where single vaccination gave only 17.5 percent protection, the double vaccinations induced 99 percent protection.

Although 10 to 12 percent of the pigs used in this experiment either gained no immunity to hog cholera or were susceptible to some other disease during the trials, no cholera outbreaks took place on the 60 farms cooperat-

ing in this study during the 5-year period.

Heat Plus Time Inactivates Virus

Hog cholera virus in blood or serum is destroyed by heating to 69° Centigrade and holding at this temperature for 30 minutes. It is not destroyed at 68° unless kept at this temperature for 60 minutes. Blood virus is not destroyed when heated momentarily to boiling.

This information is important for destroying virus in heat-processed meat. It has been known for some

time that raw pork in table scraps or garbage can contain lethal hog cholera virus. Also, it has been found, the virus can live for some time in certain forms of processed pork, such as ham, bacon, or salt pork.

Preliminary studies by ARS scientists at the National Animal Disease Laboratory, Ames, Iowa, indicate that other pork products—sausage or franks, for example—many contain virulent virus unless they are cooked long enough at high-enough temperatures.





Cooking garbage, by holding it at boiling temperatures for at least 30 minutes, will destroy any virus that may be present.

Vaccine and Serum Are Used

In Suwannee County, Fla., an experiment has been underway since April 1957 to find out if hog cholera could be eradicated through the use of modified live-virus vaccines and anti-hog-cholera serum. Here are some of the highlights of this test, conducted by ARS and the Florida Division of Animal Industry:

1. From April 1956 through June 1963, an average of 73 percent of the hogs in the test area were vaccinated each year. About 4.5 percent of the vaccinated pigs were challenged with virulent hog cholera virus. Of these, about 88 percent were fully protected and 91 percent survived challenge of virulent hog cholera virus.

2. Environmental stress had no effect on the development of immunity to hog cholera.

3. The age of the vaccine had a direct effect, however; the longer the vaccine remained on the shelf, the lower the resulting immunity.

4. Anti-hog-cholera serum was administered with the modified live-virus vaccines to prevent post-vaccination reactions. But serum dosages of 20 milliliters or more resulted in lower immunity than smaller serum dosages.

5. More than half the feeder pigs sold at public market in Suwannee County during the test period had not been vaccinated. But those purchased by Suwannee County farmers were vaccinated before being re-

moved from the market.

In fiscal year 1959, the third year of the test, 81.3 percent of confirmed cases of hog cholera in the area were associated with recent purchases of hogs from a public market. However, since then, 76.2 percent of the cases have occurred in hogs that had been on the same farm since birth. The scientists are now determining the source of the virus in these farm-raised hogs.

Disinfectant Proves Effective

Research at Ames has proved the effectiveness and safety of sodium o-phenylphenate for disinfecting farms, trucks, sales barns, and packing houses where hog cholera virus may be present. This material, used for disinfecting hospitals, is manufactured and sold for farm use under various trade names.

Developing Cholera-Free County

The first progress report on the hog cholera eradication experiment in Lowndes County, Ga., has been issued by the ARS and the Georgia Commissioner of Agriculture. This county was designated a cholera-free test area, to determine the booster effect obtained from double vaccination with safe, killed-virus vaccines. The vaccines were developed at the Animal Disease Station, Beltsville, Md.,

and confirmed in the Iowa tests.

Starting January 29, 1961, 97 percent of the hogs in Lowndes County received two vaccinations during a 2-month period. After that, all pigs born on farms in the county were also double vaccinated. Purchased pigs received vaccine and serum at the market and were revaccinated on the farm 30 days later.

No cases of hog cholera have been confirmed in the test county since double vaccination was started. During this time, 24 cases have occurred in adjoining counties and 312 cases in all of Georgia. Nonvaccinated control hogs in the test area have been checked routinely for susceptibility to hog cholera.

Results of these experiments confirm that the killed-virus vaccines are safe and effective. Hogs on Lowndes County farms have been free of live hog-cholera viruses throughout the test period.

The relative immunity of single- and double-dose vaccinated pigs was measured by challenging them with virulent virus. These pigs were purchased at market age from Lowndes County farms. Pigs receiving a single dose of vaccine have 70.7 percent protection, compared with 84.9 percent for pigs getting the double dose. The respective survival rates were 79.1 and 92.8 percent for the two groups.☆

INSTANT MASHED POTATOES



Utilization research paves the way for rural-oriented industry

■ “. . . the Department of Agriculture has embarked on Rural Areas Development. The aims are to revitalize and recapitalize town and country . . . and to provide . . . new economic opportunities.” Orville L. Freeman.

ARS studies have done much to aid industrial development that can bring new vitality to rural areas.

Two ARS scientists, for example, have developed a process leading to a multimillion-dollar rural-oriented industry—dehydrated mashed potatoes, a convenience food for hurried housewives. Work by J. M. Willard, Jr., and James Cording, Jr., resulted in three public service patents, royalty free and available to any U.S. citizen.

Today, more than 10 potato-processing plants, stemming from those patents, are located in major potato-producing areas.

One is in Grafton, N. Dak., where many Walsh County potato producers and area residents are enjoying added income, and the town added revenue, from the almost \$1½ million the local potato-processing plant adds to the community each year.

The Grafton potato-processing plant employs from 50 to a peak of 160 employees. All are from the immediate area. The busiest processing time is ideal for area farmers to gain added part-time employment, since it extends from late fall, after harvest, until early spring, before plowing. This means that many farmers can

work in the plant, processing their own farm product into instant mashed potatoes.

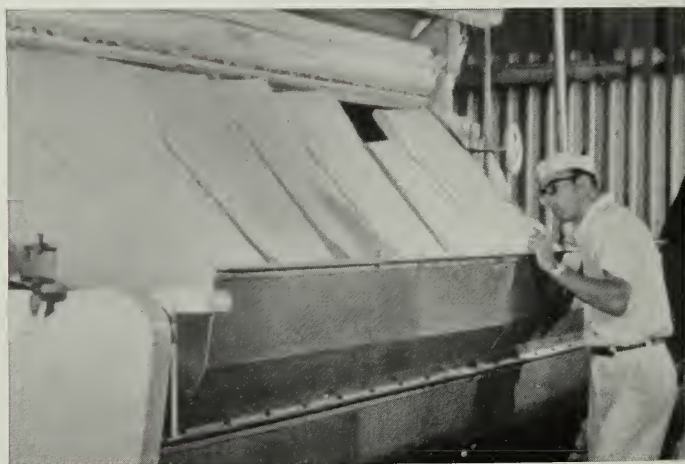
During the 1961–62 season, the plant purchased 43 million pounds of potatoes—valued at almost 2½ million dollars—from farmers in the Grafton area. Employees earned salaries amounting to \$400,000. Taxes and payments for such supplies and services as water and sewage disposal add up to a local expenditure of \$1,446,100 for that year.

And this is but one plant in one area. Multiply this by at least 10 similar potato-processing plants now operating in other rural areas and it adds up to quite a dividend from one

ARS utilization research effort.

Like Grafton, many rural areas are making a special effort to attract industries—particularly those based on locally grown products. To promote this effort, new industrial uses for farm products are being sought. Proteins from soybeans, starch from grains, gums from pines, oils from seeds, and fats from livestock are all being transformed by research into valuable industrial products.

More than a hundred small paint manufacturers, for example—many located in rural areas—are now using an ARS formula to produce linseed oil-in-water paints that wash readily from rollers, brushes with water.☆



Moisture in freshly cooked mashed potatoes is reduced to 5 percent in only 20 seconds in this ARS-developed drum dryer. Sheets of dried potatoes are then broken into flake size for packaging.

The Eucalyptus

Horticulturists find this tree species, known since Biblical times, well suited to suburban needs



This north Australian species, Eucalyptus alba, was planted at Miami in 1924. It is one of 17 of this species, now averaging 60 feet tall with a spread of 30 feet.

■ Four species of *Eucalyptus*, a tree genus that dominates the great forests of Australia, are well suited for the special landscaping requirements of south Florida, ARS horticulturists have found.

Other species of this tree, mentioned various times in the Bible, are established in Maryland, Texas, and Arizona, and on the west coast.

The four species chosen for Florida are from 109 different eucalypts planted and evaluated in extensive field tests at the U.S. Plant Introduction Station near Miami. The promising ornamentals for south Florida are *Eucalyptus alba*, *E. citriodora*, *E. crebra*, and *E. deglupta*. A fifth species, *E. torrelliana*, looks promising also but needs further testing.

Eucalypts have a special appeal to ornamental horticulturists because the genus includes many species that tolerate extremely low temperatures and many other species—like the group tested in Florida—that stand heat well. Many are rapid growers.

One species of eucalypt has been grown successfully by ARS in Mary-

land, and cooperating nurserymen are now testing it as far north as Philadelphia. On the west coast, introductions of the trees are established in Oregon, Washington, and California.

In common with many eucalypts, the species chosen for Florida have excellent form and are extremely fast growers. This speed of growth meets a need created by today's highly mobile population, which has caused rapid expansion of suburbs. Modern homebuilders want trees that will grow quickly to cover ground that has been cleared and leveled to make way for housing.

Results of the Florida evaluations have been reported by horticulturists P. K. Soderholm and M. N. Gaskins of the Miami station and H. F. Winters of the Agricultural Research Center, Beltsville, Md.

No special disease or insect problems developed in the four species at Miami, and each withstood at least one hurricane during its test period, the team reports.

E. alba, commonly known as white

gum, is a north Australian species first planted at Miami in 1924. A number of the original trees are still growing. These average 60 feet in height and have an average spread of 30 feet.

E. citriodora is considered best for group plantings around large buildings or such structures as bridges. Seeds of this species were first planted on a limestone ridge at the Miami station in 1942. The plantings had reached an average height of 24 feet by 1945 and today average 55 feet in height, with trunks averaging 7 to 9 inches in diameter.

E. crebra, a native of New South Wales, has proved highly wind resistant. Seven of nine trees planted in 1942 are still in excellent condition. Three years after planting, one of them had reached a height of more than 25 feet.

The species *E. deglupta* is distinguished by unusually colorful bark. An outer layer peels in narrow strips, exposing a smooth underbark of olive green, light green, and rust. This species, a native of New Guinea, the Celebes, and the Philippines, has been growing at Miami since its introduction in 1952 as year-old seedlings. The plants were set out in marl soil under which the water table varies from 2 to 4 feet. Growth at this particular location was extremely rapid—after 7 years, the trees averaged 60 feet in height, with a medium-dense canopy averaging 30 feet in diameter.

Observations of *E. torrelliana* thus far indicate that it would be excellent for individual planting in a small residence yard. Trees set out in 1945 now average 20 feet in height. This eucalypt comes from an original introduction by Harvard University's Arnold Arboretum.★



FREEING THE AIR OF DUST

Research that has reduced cropland damage has also eliminated much human discomfort

■ The official weather record for April 6, 1893, at Dodge City, Kans., carried this comment by the observer:

"The dust was blinding and was deposited so thickly on office furniture that everything looked as though it were covered by a layer of dirt prepared for a hotbed."

Plains residents remember the mid-1930's as the time when they vainly stuffed rags in windows to keep out the fine dust, wiped the grit from dishes just before serving each meal, and removed a gray dust film from their faces after every excursion outdoors. Street lights burned at midday, and zero visibility halted traffic.

From then until now, the human discomfort associated with duststorms has plagued Great Plains residents. But application by farmers and ranch-

ers of ARS research since the notable "black blizzards" of the 1930's has reduced the number and severity of these storms.

The great economic losses from wind erosion sustained by farmers and townspeople stimulated research that has precisely defined the conditions favoring soil blowing and has developed effective prevention methods. Much of this research was directed by the late W. S. Chepil, ARS soil scientist, at the Wind Erosion Laboratory, Manhattan, Kans., in cooperation with State agricultural experiment stations

The comparative number of duststorms occurring on the Great Plains in the 1930's and 1950's indicates the progress made in reducing the discomfort and the economic losses caused by swirling clouds of dust.

Climatic conditions—low precipitation, high temperatures, and strong winds—were equally favorable for severe erosion. Even so, U.S. Weather Bureau records show that Dodge City had 123 duststorms in 1937 and only 41 in 1955.

Farmers whose soils are easily erodible—on the Great Plains and elsewhere—are the direct beneficiaries of wind-erosion research. But everybody has shared in the improved economic conditions resulting from erosion control, and its value to the nonfarm population is becoming increasingly important as urban communities grow in erosion-prone areas.

Many notable accomplishments are coming from research on wind erosion. ARS and State scientists, for example, have—

Soil scientists at Manhattan, Kans., use a field wind tunnel to test plots of ground that have been treated to stabilize the soil with various materials, such as asphalt, resins in water emulsions, latexes, and starches.

- Developed an equation for determining the potential average annual erosion from a field (AGR. RES., October 1961, p. 8). The equation evaluates the influence on erosion of the erodibility of the soil, average wind velocity, average moisture and roughness of the soil surface, field width, and vegetative cover.

- Proved the effectiveness of temporary and permanent vegetative cover, which under certain circumstances will remove up to 99 percent of the direct wind force at the soil surface.

- Found which regular tillage practices most effectively restrict soil loss and established the usefulness of listers, duckfoot cultivators, and narrow-tooth chisel cultivators for emergency tillage.

- Showed that narrow windbreaks made up of trees and shrubs (1 to 5 rows) will protect fields and farmsteads as well as the wide belts (10 or more rows) planted in the 1930's and 1940's.

- Tested the effectiveness of strips of sorghum or other tall-growing crops for preventing erosion and for

trapping snow to increase moisture available to succeeding crops.

Urban residents of areas where the wind-erosion hazard is high will be further protected from the discomfort of dust storms when methods of predicting severe erosion conditions are in general use (AGR. RES., January 1963, p. 5). The scientists have demonstrated their ability to forecast, 6 months in advance, when conditions favorable to duststorms are likely to occur. Farmers are thus warned in time to take emergency erosion-control measures.

Public comfort and the economic losses to communities from wind erosion are dictating greater attention to nonagricultural lands—highways, rights-of-way, airports, building and industrial sites, and military installations. ARS scientists have also tested erosion-preventing measures especially suited to these nonfarm sites. Information was obtained on artificially anchored vegetative mulches, various organic and inorganic liquids, and gravel and crushed rock mulches.

As on farmland, the permanent vegetation commonly prevailing gives

the most complete erosion prevention. But until grasses or other plants are established, the scientists say a vegetative mulch anchored with a disk packer is the most effective temporary treatment. Resins, asphalts, latexes, and other organic or inorganic films controlled wind erosion when applied in sufficient quantity and concentration, but costs were higher than for vegetative mulch.

This many-pronged research attack, better farming methods and equipment, and most important—acceptance by farmers of results of research—have greatly reduced the chances for occurrences of blinding dust such as Dodge City's in 1893. The odds will be further improved, the ARS scientists say, as continuing research provides a still better understanding of the mechanics of wind erosion and methods of controlling it.☆



BELOW—Asphalt-treated mulch is applied in this Kansas test to provide protection against wind erosion until grass becomes established.

TOP RIGHT—Research has proved that narrow windbreaks planted closer together can be as effective as the wider belts of the 1930's and 1940's.

BOTTOM RIGHT—Stubble mulching is one of the most effective measures for controlling wind erosion.



Insect Enemy of Scotch Broom

Imported moth is helping control a noxious shrub



■ An insect that attacks only Scotch broom has been successfully established at five locations in California, where this shrub has become a noxious weed.

ARS entomologists, in cooperation with the California Agricultural Experiment Station, imported the insect from Europe. It lays eggs on the plant's stems and twigs; when the eggs hatch, the larvae bore under the bark and tunnel into the tissue, causing the stems and twigs to weaken or die.

Scotch broom is used as an ornamental in many parts of the country, but it has become a weed pest on the west coast. The shrub now occupies about 100,000 acres of range and forest land in California alone, choking off grass needed for grazing and preventing young trees from becoming established. It is also a fire hazard.

In the ARS tests, Scotch broom shrubs that were heavily attacked by the moth became covered with deadwood. Seed production of the infested shrubs declined 50 percent compared with that of uninfested shrubs. This is the first attempt in the United States to control Scotch broom by using a beneficial insect.

The moth, a stem and twig miner (*Leucoptera spartifoliella* Hubner),

was introduced into California in 1960 and additional moths were released in 1961 and 1962. During this early experimental period, the insect has made limited inroads on Scotch broom stands.

By weakening or destroying new plant growth, the beneficial miner creates a continuous stress on even the largest Scotch broom shrubs. It causes heaviest damage to the lower branches, which die and fall off. Grass is then able to grow under the shrubs, and animals can graze more freely. As the lower branches are thinned out, particularly in forest areas, pine seedlings may be able to compete successfully with the shrub.

In laboratory tests with three other broom species, ARS scientists found no evidence of stem or twig mining following introduction of *L. spartifoliella* into cages containing the plants. One species, French broom, exists with Scotch broom in Mill Valley, California. At this location—one of the insect release sites—the miner infested only Scotch broom.

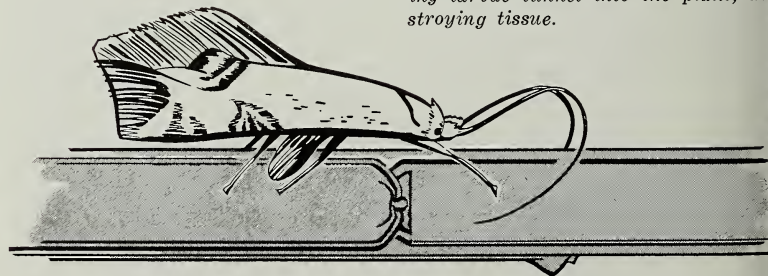
Since 1960, natural populations of the miner have been reported in Washington at Tacoma, in northwestern California, and in the San Francisco Bay region. It is believed to have been accidentally introduced in these areas with the host plant.

Natural increases of *L. spartifoliella* are expected to have a marked effect on Scotch broom. But to hasten dispersal, future releases may be made by collecting the miner at established sites for release in new areas.

At Tacoma, and in California's Del Norte County, a parasite attacks the miner. This parasite, a European species, did not appear at any of the release locations, but it could impair the miner's future usefulness.

In further research on insect control of Scotch broom, a seed weevil that infests the shrub in Europe will be brought to the United States and released in California this year. Larvae of the weevil, *Apion fuscirostre* F., feed only on the seeds of Scotch broom. The insect does not attack other plants.★

The female Leucoptera lays eggs on the stem of Scotch broom. The resulting larvae tunnel into the plant, destroying tissue.



Pathogen-free animals for research

Pathogen-free animals, uncontaminated by any disease-producing viruses, bacteria, fungi, helminths, and protozoa, are being raised successfully for ARS research at the National Animal Disease Laboratory, Ames, Iowa.

These animals—calves, pigs, lambs, poults, chicks, and guinea pigs—are used in experiments aimed at preventing, curing, or controlling animal diseases. If such experiments are to be valid, scientists must use animals that are not only free of the specific pathogen being studied but also of other disease-causing organisms, which may produce disease during experiments.

The first objective in starting colonies of pathogen-free animals was to eliminate transmission of certain pathogenic organisms from the mother to her young. This was done, where applicable, by removing unborn ani-

mals from the uterus by cesarean section or hysterectomy and placing them in sterilized cages in previously fumigated rooms. Eggs were sterilized and hatched in incubators that had also been fumigated.

To keep pathogens out of the rooms, all incoming materials were sterilized and passed through airlocks. Before entering, personnel showered and changed into sterile clothing.

Feed was either sterilized or examined for pathogens before use.

Liquid diets were sterilized with beta-propiolactone, a chemical known for its effectiveness against many disease-producing organisms. The Ames scientists have found that this chemical—normally injurious to an animal's stomach lining—decomposes, before it is fed, into harmless end products within a few hours after it has been added to the liquid diet.

Rearing procedures are varied to fit each pathogen-free species.

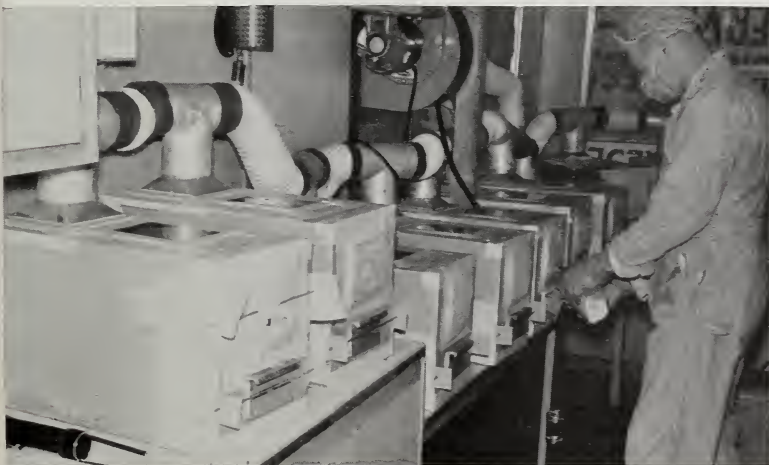
Two new research laboratories

Plans are underway to build two new ARS regional research laboratories—one at Athens, Ga., for utilization research, and the other at Stoneville, Miss., for weed research. Funds for the new facilities have been made available by Congress.

The Athens Laboratory will be headquarters for a Southeastern Utilization Research and Development Division, on a par with existing utilization divisions at Philadelphia, New Orleans, Peoria, Ill., and Albany, Calif. It will provide research and pilot-plant facilities for a concerted effort to find new and improved uses for the important farm commodities of the southeastern region. The new facility at Athens is expected to be in operation in 1967.

The Regional Weed Research Laboratory at Stoneville, Miss., will conduct research to develop new principles and practices for controlling weeds more effectively, safely, and economically. Particular emphasis will be given to methods that will have no adverse effects on crops, fish and wildlife, or community water supplies. Attention will be given first to weeds in cotton crops grown in rotation with cotton. Later, other weed control problems of the South will be studied. The laboratory is expected to be in operation in 1966.

Athens and Stoneville were chosen for their central positions in areas with specific need for the research to be done, and for their proximity to other Federal and State research facilities concerned with regional problems.



Pathogen-free pigs, one per disposable box, are maintained in this sterile environment for the first 10 days of their lives.

AGRISEARCH NOTES

Dedication . . . above and beyond

Never underestimate the dedication of a true scientist.

A recent experience of J. G. Shaw, ARS entomologist, provides an example of dedication that goes above and beyond the call of duty.

The incident occurred in Mexico, where Shaw has been rearing and sterilizing Mexican fruit flies as a possible means of controlling this dangerous fruit pest.

He was on his way to Nueva Leon, Mexico, to liberate a batch of experimental sterilized flies when it began to rain. The temperature dipped to the low 40's and the experiment was endangered.

Reacting swiftly, Shaw parked his car and checked into a Mexican hotel—taking his flies with him. Luckily the room contained two beds. He removed the sheets and covers

from one bed and covered the fly cages to keep out the light and keep in heat generated by the flies.

Then, the entomologist went to work stoking the fireplace to raise the room temperature to between 70° and 85°—the best range for Mexican fruit flies. This went on for 4 days and nights. Despite gallant efforts, he seldom got the mercury above the 65° mark. The fireplace smoked terribly, and Shaw was forced to raise a window once in awhile to get a breath of fresh air. This, of course, lowered the temperature.

This story has a happy ending. The flies survived the uncomfortable conditions. On the fifth day, the sun peeked through the clouds and the temperature began to climb. Leaving the sanctuary of the hotel, the intrepid entomologist and his little brood continued their journey. The tests were successfully carried out.

Culvert design triples flow

A single culvert, 72 inches in diameter, under a Minnesota highway handles runoff that would have required two 108-inch culverts if the designers had not applied research findings.

Plans for Highway 5 near the entrance to the Minneapolis-St. Paul International Airport originally called for the larger, more expensive culverts. But the designers consulted ARS hydraulic engineer F. W. Blaisdell, who suggested a modification originally developed for use on structures for farm ponds and upstream flood protection.

The 72-inch culvert proved adequate because it was equipped with a hood inlet and because flows in excess of culvert capacity are temporarily stored to a depth of 28 feet over the culvert entrance. Embankments 75 feet high permit temporary storage above the culvert inlet.

The hood inlet, developed by ARS in cooperation with the St. Anthony Falls Hydraulic Laboratory, Minneapolis, and the Minnesota Agricultural Experiment Station, insures that the culvert will flow full of water. Without the hood inlet, only part of the culvert capacity would be utilized.

Detention storage is often used by USDA's Soil Conservation Service in designing flood protection reservoirs.

Structures developed by ARS at the St. Anthony Falls Laboratory are also incorporated in the exit of the 460-foot-long culvert.

